

# Engineering Specification Report

*Plant Design Document Analysis*

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## ENGINEERING SPECIFICATION ANALYSIS

Focus Area: Entire Document

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**1. PURPOSE AND SCOPE OF DOCUMENTS:**

- Piping/nozzle load analysis for tank shell openings and vendor deliverable requirements for "Nozzle load Analysis" during Manufacturing & site erection (From 10080-1-SS-ME-004, 12.2.viii).
- Tank design to follow API 650 and its Supplement; Appendix P mandatory for allowable external loads on tank shell openings (From 10080-1-SS-ME-004, Appendix P).
- Project-level environmental/structural load standards applicable to nozzle load evaluation (wind, seismic) as referenced for design inputs (From BEDD EPCMD-1-DBD-GE-001, section 5.2.2 and BEDD / 10080-1-SS-ME-004 Appendix E).
- Units and conventions for load reporting (Force = N, Moment = Nm, Loading (linear) = kN/m, Loading (surface) = kN/m<sup>2</sup>, Pressure = kg/cm<sup>2</sup> g) (From BEDD Section 6 Units).
- Scope includes contractor confirmation of acceptability of specified external nozzle and support pad loading for tank design (From 10080-1-SS-ME-004, Appendix P, P.1.1).

**2. APPLICABLE CODES, STANDARDS, AND REFERENCES:**

- "API 650" (general tank design code referenced) (From 10080-1-SS-ME-004).
- "API 650 Appendix P" (mandatory for Allowable External Loads on Tank Shell Openings) (From 10080-1-SS-ME-004, Appendix P).
- "IS 875 (Part 3)" (wind design standard referenced) (From BEDD EPCMD-1-DBD-GE-001, section 5.2.2).
- "IS 1893" (seismic design standard referenced; tanks Appendix E also requires IS 1893 / IITK-GSDMA guidance) (From 10080-1-SS-ME-004 Appendix E and BEDD).

- "IITK-GSDMA guidance" (referenced for seismic/tanks) (From 10080-1-SS-ME-004 Appendix E).
- Software list: "CAESAR, NOZZLEPRO, CAEPIPE" accepted for piping stress / nozzle analysis (From BEDD EPCMD-1-DBD-GE-001, section 5.2).

### 3. DESIGN AND PERFORMANCE REQUIREMENTS:

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#### **- API 650 Appendix P nozzle-load table values to be used as minimum requirements for shell-mounted nozzle design (From 10080-1-SS-ME-004, Appendix P).**

- Loads for nozzles  $\leq 2"$  are considered negligible (From 10080-1-SS-ME-004, Appendix P note).
- Loads for nozzles  $> 24"$  to be agreed between CONTRACTOR and CONSTRUCTION MANAGER (From 10080-1-SS-ME-004, Appendix P note).

#### **- Contractor must confirm acceptability of specified external nozzle and support pad loading or advise maximum acceptable loading for the tank design (From 10080-1-SS-ME-004, Appendix P, P.1.1).**

- Wind design: site wind speed = 50 m/s, terrain category 2, Group B,  $K1=1.08$ ,  $K2=1.1$ ,  $K3=1.0$ , shape factor = 0.7 (From BEDD EPCMD-1-DBD-GE-001, section 5.2.2 addition).
- Seismic design: compliance with IS 1893 and referenced soils/spectra per EPCMD-1-ENGG-DBD-CS-002 (From BEDD 7.1 Note and 10080-1-SS-ME-004 Appendix E).
- Units for reporting loads: Forces in N, Moments in Nm (From BEDD Section 6 Units).
- Pressure units for battery limits: kg/cm<sup>2</sup> g (From Attachment 3 battery limit conditions).

### 4. MATERIAL AND COMPONENT SPECIFICATIONS:

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- None found explicitly in the provided documents. (From "new\_test - Copy.pdf")

## 5. LOADS, ALLOWABLES, AND DESIGN DATA:

- Nozzle allowable loads (at nozzle-to-shell junction) per API 650 Appendix P: Nozzle size 3" - Radial load 1000 N ; Circumferential moment 200 Nm ; Longitudinal moment 200 Nm (From 10080-1-SS-ME-004, Appendix P).
- Nozzle size 4" - Radial load 1500 N ; Circumferential moment 300 Nm ; Longitudinal moment 300 Nm (From 10080-1-SS-ME-004, Appendix P).
- Nozzle size 6" - Radial load 2500 N ; Circumferential moment 700 Nm ; Longitudinal moment 700 Nm (From 10080-1-SS-ME-004, Appendix P).
- Nozzle size 8" - Radial load 4000 N ; Circumferential moment 1500 Nm ; Longitudinal moment 1500 Nm (From 10080-1-SS-ME-004, Appendix P).
- Nozzle size 10" - Radial load 5000 N ; Circumferential moment 2500 Nm ; Longitudinal moment 2500 Nm (From 10080-1-SS-ME-004, Appendix P).
- Nozzle size 12" - Radial load 7000 N ; Circumferential moment 4000 Nm ; Longitudinal moment 4000 Nm (From 10080-1-SS-ME-004, Appendix P).
- Nozzle size 14" - Radial load 9000 N ; Circumferential moment 6000 Nm ; Longitudinal moment 6000 Nm (From 10080-1-SS-ME-004, Appendix P).
- Nozzle size 16" - Radial load 11000 N ; Circumferential moment 8000 Nm ; Longitudinal moment 8000 Nm (From 10080-1-SS-ME-004, Appendix P).
- Nozzle size 18" - Radial load 13000 N ; Circumferential moment 10000 Nm ; Longitudinal moment 10000 Nm (From 10080-1-SS-ME-004, Appendix P).
- Nozzle size 20" - Radial load 15000 N ; Circumferential moment 13000 Nm ; Longitudinal moment 13000 Nm (From 10080-1-SS-ME-004, Appendix P).
- Nozzle size 24" - Radial load 20000 N ; Circumferential moment 18000 Nm ; Longitudinal moment 18000 Nm (From 10080-1-SS-ME-004, Appendix P).

**- Note: Loads for nozzles  $\leq 2$ " considered negligible; loads for nozzles  $> 24$ " to be agreed between CONTRACTOR and CONSTRUCTION MANAGER (From 10080-1-SS-ME-004, Appendix P note).**

- Wind: 50 m/s 3-second gust at 10 m elevation for onshore facilities (50-year return) (From BEDD 7.2.1).
- Steam battery limit conditions - HHP Steam: Normal 106 kg/cm<sup>2</sup> g (range 101-109) ; Normal temp 510°C (range 490-515) ; Design pressure 117 kg/cm<sup>2</sup> g ; Design temp 540°C (From

Attachment 3, Steam Battery Limit Conditions).

- Steam battery limit conditions - HP Steam: Normal 42.2 kg/cm<sup>2</sup> g (40.1-43.2) ; Normal temp 383°C ; Design 47.6 kg/cm<sup>2</sup> g ; Design temp 426°C (From Attachment 3, Steam Battery Limit Conditions).
- Steam battery limit conditions - MP Steam: Normal 16 kg/cm<sup>2</sup> g (15-17.2) ; Normal temp 232°C ; Design 21.1 kg/cm<sup>2</sup> g ; Design temp 288°C (From Attachment 3, Steam Battery Limit Conditions).
- Steam battery limit conditions - LP Steam: Normal 4.1 kg/cm<sup>2</sup> g (3.5-4.6) ; Normal temp 158°C ; Design 8.1 kg/cm<sup>2</sup> g ; Design temp 260°C (From Attachment 3, Steam Battery Limit Conditions).

## 6. EXECUTION, TESTING, AND QUALITY REQUIREMENTS:

- Vendor deliverable requirement: "Nozzle load Analysis" required submission item

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## END OF ENGINEERING SPECIFICATION ANALYSIS

## End of Report